

# The electricity certificate system, 2007



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## Preface

1st May 2007 marked four years of the Swedish electricity certificate system, during which time the system has developed and changes have been made. With the aim of providing easily accessible information on the development of the system, and to improve general understanding of it, the Swedish Energy Agency publishes its report 'The Electricity Certificate System, 2007'.

This report describes the market status of the electricity certificate system, and includes statistics from 2003 to 2006. It is our aim to create a forum for continuously developing the statistical material and analyses, in order to assist those involved in the market, and all other interested persons, to follow achievement of the objectives set out in the Government's Bill No. 2005/06:154, Renewable Electricity with Green Certificates. It is also our aim that, in future, each issue of the report should include a more in depth theme article on some particular subject. This year the report provides expanded information and statistics on wind power. We welcome views on the content and presentation of the report in order further to improve it.

André Höglund, as the project manager, and Roger Östberg have been responsible for preparing this report, which forms a part of the Swedish Energy Agency's work of monitoring, providing information to, and analysing the electricity certificate market. In addition, Mattias Eriksson, Jenny Hedström, Maria Westrin and Ellen Åhlander have assisted in the work of preparing the report.



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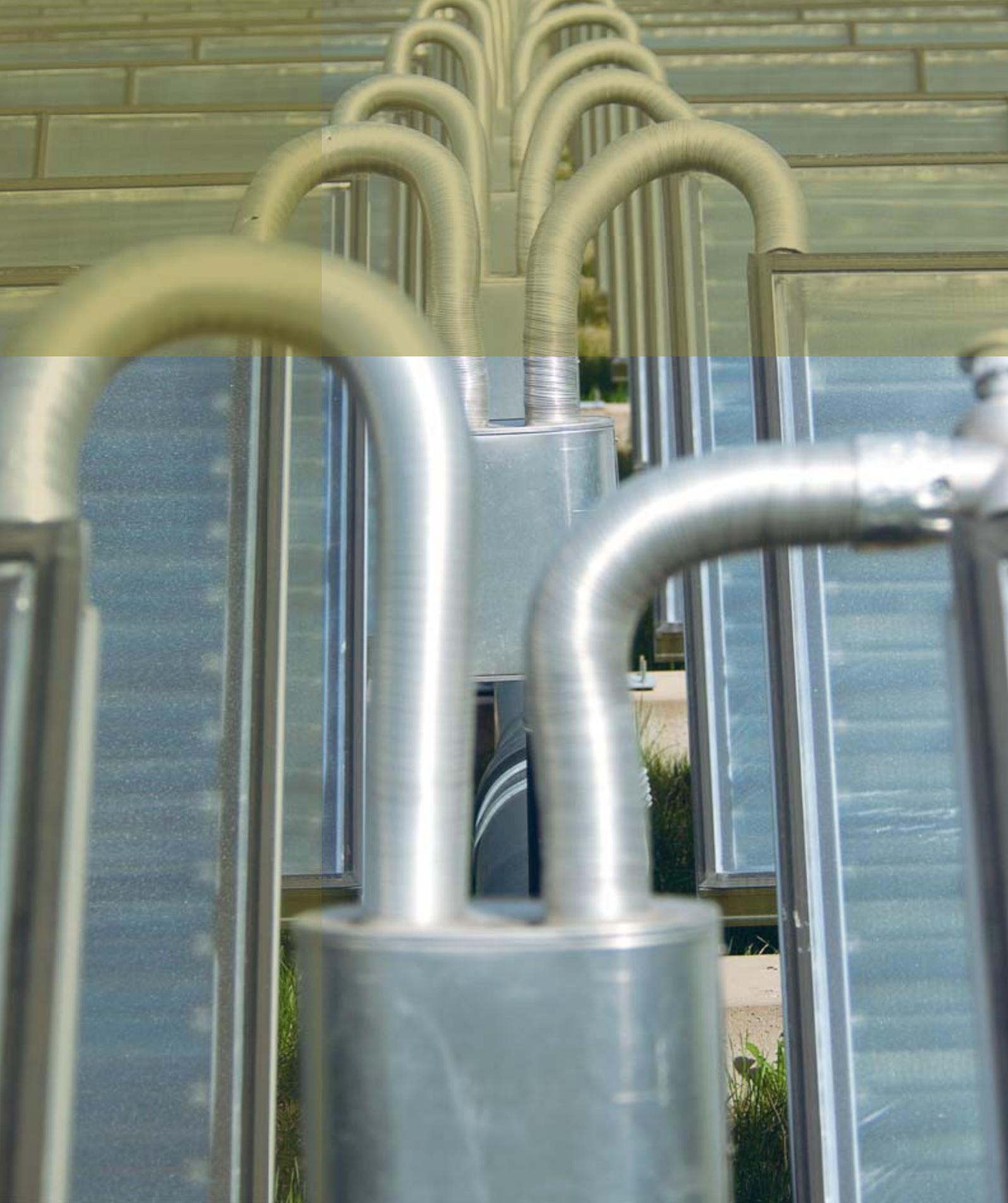


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# Background to the electricity certificate system

*The electricity certificate system is a market based support system to assist the expansion of electricity production in Sweden from renewable energy sources and peat. Its objective is to increase the production of electricity from such sources by 17 TWh by 2016 relative to the production level in 2002. It is part of the country's overall objective of moving Sweden towards a more ecologically sustainable energy system.*

In 2002, Sweden produced 70.3 TWh of electricity from renewable energy sources, of which about 90% were in the form of large scale hydro power. The EU and Sweden's Parliament have ambitious targets for the production of electricity from renewable energy sources and, in order to meet them, Sweden introduced its electricity certificate system in May 2003. The objective of the system was to increase the production of electricity from renewable energy sources by 10 TWh by 2010, relative to the corresponding production in 2002. In subsequent years, the objective of the legislation has been expanded, so that it now also includes encouragement of the production of electricity from peat as a fuel in combined heat and power plants.

Electricity producers whose electricity production fulfils the requirements in the Electricity Certificates Act receive one electricity certificate unit for each megawatt hour of electricity that they produce. Demand for certificates is created by the fact that all electricity suppliers – i.e. resellers, delivering electricity to end users – and also certain electricity users, are required to purchase certificates corresponding to a certain proportion (quota) of their electricity sales or electricity use. The quantity of certificates to be purchased increases from year to year in step with progressive increases of the quota proportion, thus generating a corresponding increase in demand for the certificates. In turn, this increases the incentive to produce more electricity from energy sources approved for production of electricity entitled to certificates. Through the sales of their certificates, producers of electricity from renewable energy sources receive an additional revenue from and for their production of electricity. In this way, the system encourages the expansion of electricity production from renewable sources, and new technologies.

The Electricity Certificates Act was amended by Parliament on 14th June 2006, raising its target levels. With effect from 1st January 2007, the target of the act is now to increase the production of electricity from renewable sources by 17 TWh in 2016, relative to corresponding production in 2002.

## The producer's right to electricity certificates

One electricity certificate unit is issued to each approved producer (i.e. electricity producer operating an approved plant) for each produced and metered megawatt hour of electricity from renewable energy sources, or from peat. Electricity produced from the following energy sources is entitled to certificates:

- Wind power
- Solar energy
- Wave energy
- Geothermal energy
- Biofuels, as defined in the Ordinance (2003:120) Concerning Electricity Certificates
- Peat, when burnt in combined heat and power production (CHP) plants
- Hydro power
  - small scale hydro power which, at the end of April 2003, had a maximum installed capacity of 1500 kW per production unit
  - new plants
  - resumed operation from plants that had been closed
  - increased production capacity from existing plants
  - plants that can no longer operate in an economically viable manner due to decisions by the authorities or to extensive rebuilding.

## Restrictions on rights to certificates

The electricity certificate system is intended to support the construction of new plants for the production of electricity from renewable energy sources and from peat. However, in order to limit the cost to consumers of electricity from such sources as older, commercially viable plants, there is a time limit on the right of producers to receive certificates. Plants commissioned after the start of the electricity certificate system are entitled to receive electricity certificates for 15 years,

or until the end of 2030, whichever is the earlier. Plants that were started up before the certificate system was introduced are entitled to certificates until the end of 2012. Plants that, at the time of their construction or conversion, received a public investment grant after 15th February 1998 (in accordance with a grants programme for certain investments within the energy sector), are entitled to certificates until the end of 2014.

### Quota obligation

Electricity suppliers (i.e. companies distributing electricity to end users) are required to purchase electricity certificates corresponding to a certain proportion of the electricity that they sell, known as their quota obligation. In order to fulfil their obligations, the suppliers are required to submit an annual return to the Swedish Energy Agency with details of the amount of electricity that they have invoiced to their customers during the previous year, together with certificates corresponding to a certain proportion (quota) of their sales. These returns are required by not later than 1st March each year. In addition to electricity supply companies, the requirement to purchase a certain proportion of certificates (i.e. a quota obligation) also applies to electricity intensive companies and to electricity users who have used electricity that they have themselves produced, imported or purchased on the Nordic electricity exchange.

### Who does what?

The Swedish Energy Agency and Svenska Kraftnät share responsibility for the electricity certificate system, with the Agency being the compliance authority and Svenska Kraftnät being the accounting authority. Their duties are as follows.

The Swedish Energy Agency:

- Approves plants entitled to certificates
- Registers/deregisters parties etc. having quota obligations, and checks their annual returns with information on quota liable electricity
- Decides on late delivery penalties for those required to submit annual returns but who do not do so by 1st March
- Decides on a quota obligation charge (effectively a penalty) if the quota obligation is not fulfilled

- Redeems electricity producers' unsold certificates at a guaranteed price
- Is the compliance authority in respect of compliance with the Act, Ordinance and regulations concerning electricity certificates
- Publishes information on the electricity certificate system
- Monitors and analyses developments on the electricity certificate market.

Svenska Kraftnät:

- Issues electricity certificates based on metered values from certificate entitled electricity production
- Prepares and maintains the certificate register with details of certificate holdings
- Cancels certificates on 1st April each year, in accordance with information in the returns received and checked by the Swedish Energy Agency
- Publishes regular information on the number of certificates issued, traded and cancelled, and on their average price.

### Important dates in the electricity certificate system

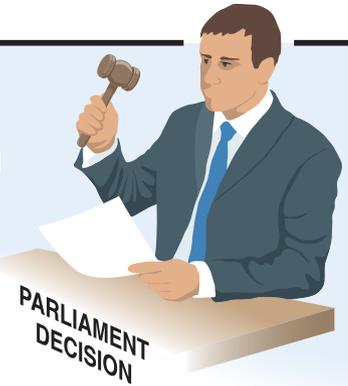
**1st March:** Final date for those having quota obligations to submit their returns of electricity sales and electricity use, on which the previous year's quota obligation has been based.

**31st March:** Final date for those having quota obligations to ensure that a sufficient number of certificates is held in their certificate accounts in order to meet their obligation and, if so wished, to indicate which certificates in their account they wish to be cancelled.

**1st April:** Cancellation of the requested number of certificates, or of that number of certificates as needed to fulfil the quota obligation. If the account holds an insufficient number of certificates, the Swedish Energy Agency will decide on an appropriate quota obligation charge.

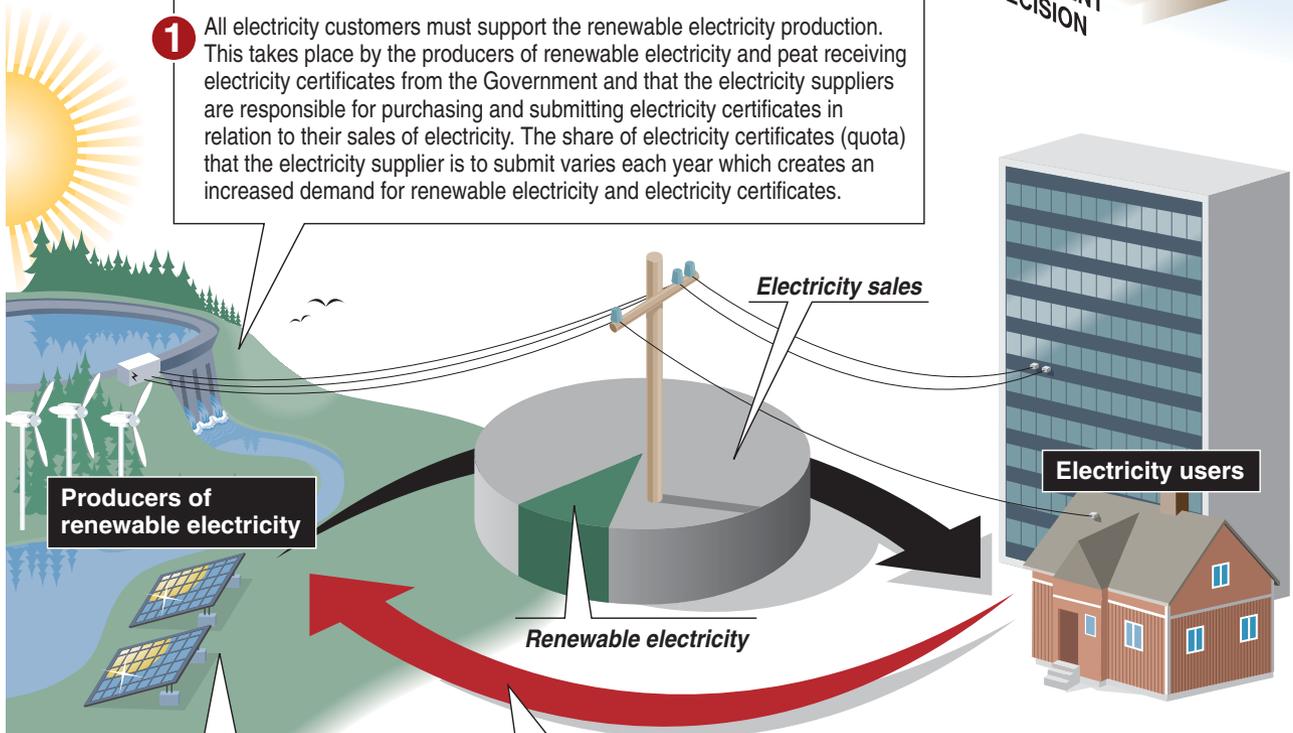
# The electricity certificate system

The Swedish Parliament has decided that the support concerning electricity production using renewable energy sources (solar energy, wind power, hydro power and biofuel) and peat is to be based on the electricity certificate system. The electricity certificate system started on the 1st of May 2003 and runs to the end of year 2030.



## The system works in the following way:

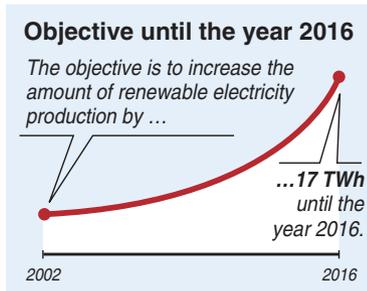
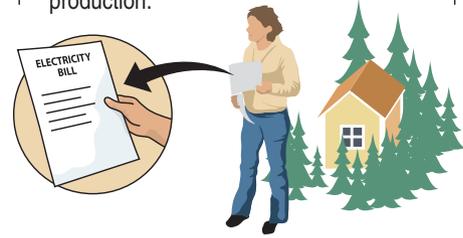
**1** All electricity customers must support the renewable electricity production. This takes place by the producers of renewable electricity and peat receiving electricity certificates from the Government and that the electricity suppliers are responsible for purchasing and submitting electricity certificates in relation to their sales of electricity. The share of electricity certificates (quota) that the electricity supplier is to submit varies each year which creates an increased demand for renewable electricity and electricity certificates.



**4** By selling electricity certificates the producers receives an extra income. This makes it profitable to invest in new renewable electricity production.

**3** Electricity suppliers declare each year the sold amount of electricity to the Swedish Energy Agency. The electricity suppliers quota obligation is calculated based on the sold amount of electricity and the quota for the previous year. On the 1st of April, each year, the electricity supplier is to submit the calculated number of electricity certificates to the Government and a cancellation is performed. Since the electricity certificate is cancelled, the electricity supplier must purchase new electricity certificates in order to meet the quota obligations for the coming year.

**2** Electricity suppliers costs regarding electricity certificates are included as part of the electricity price that the electricity suppliers charges the customers. The electricity certificate system thus leads to an increased cost for the customer but in return the system reduces the environmental impact from the electricity production.





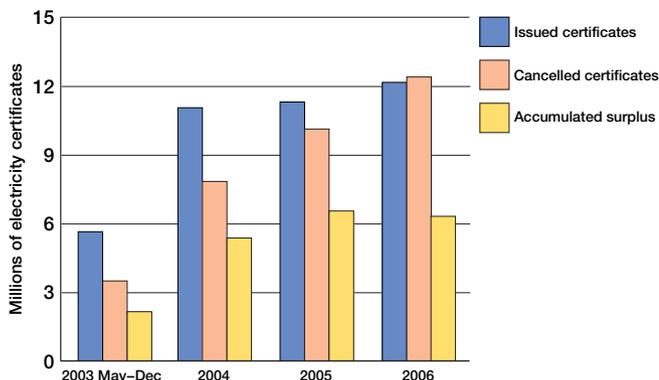
# Number of certificates available

Power plants producing electricity from renewable energy sources or from peat, and which have been approved by the Swedish Energy Agency, receive a number of electricity certificates, based on the amount of renewable electricity produced by the plant. This means that the number of certificates issued is therefore determined by the number of approved plants, by the amount of electricity that they produce and by the proportion of renewable fuel that they use. Electricity production is also affected by external factors such as temperature, precipitation, wind and the country's overall electricity balance.

During the certificate system's first years, the number of certificates issued has exceeded the demand for them, which has resulted in a surplus of tradable certificates on the market. The accumulated surplus has increased every year, as certificates have open-ended validity, and can therefore be carried forward. A change occurred in 2006, when the number of certificates cancelled exceeded the number of certificates issued. However, there is still a surplus of certificates on the market, although it has been reduced, as can be seen in Figure 1.

Of the electricity production that received certificates in 2006, 70.7% occurred in biofuel fired plants, and 4.6% in CHP plants burning peat. Wind power plants received 8.1%

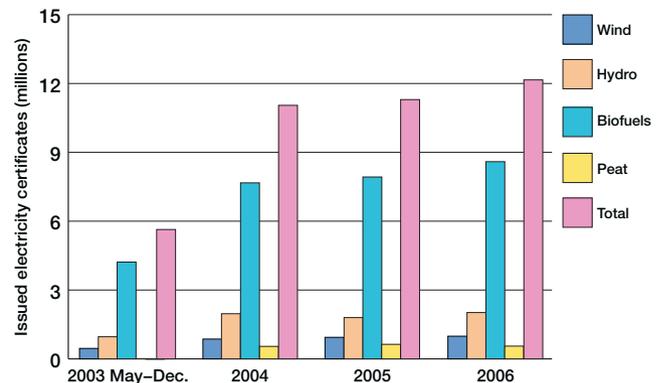
**Figure 1.** Number of certificates issued and cancelled, together with accumulated surplus over the period 2003–2006.



Source: Svenska Kraftnät's accounting system, Cesar

and hydro power plants received 16.6%, thus making significant contributions to electricity production within the system. A small number of solar energy plants were approved for reception of certificates, but the actual amount of energy that they produced during the year was small, amounting to only a few MWh. No wave energy or geothermal energy plants have so far been notified for approval and inclusion in the system. Figure 2 shows how the certificates were allocated between different energy sources over the period 2003–2006. As the system started on 1st May 2003, information for that year covers only eight months.

**Figure 2.** Number of electricity certificates issued, by types of energy source, 2003–2006.



Source: Svenska Kraftnät's accounting system, Cesar

The electricity producers on the market are a very mixed group in terms of the number of plants that they own and the scale of their electricity production. During 2006, certificates were issued to 1093 companies and private persons, with 838 of them owning only one plant. Although there are numerically much fewer plants in the bio-energy sector than in the wind and hydro power sectors, they often produce a greater total electricity production from renewable energy sources.

The producers of electricity entitled to certificates can be described as a group in which a small number of companies accounts for most of the production, with a large number of producers each contributing only a relatively small produc-



tion quantity. The structure of the group tends to remain much the same from year to year. In 2006, 96% of the producers received certificates for a production of 50 000 MWh or less, making up 18% of the total number of certificates issued during the year. The three largest producers accounted for 22% of the production entitled to certificates.

# Demand

*The demand for electricity certificates is created by the obligation that electricity suppliers and certain electricity users are required to purchase certificates corresponding to a particular proportion of their electricity sales and/or electricity use. This proportion, or quota, has been decided for each calendar year, and set at such a value that the system will play its part in achieving the objective of increasing the production of electricity from renewable energy sources by 17 TWh by 2016, relative to production in 2002.*

The quota is determined by the Act (2003:113) Concerning Electricity Certificates, and is intended to create a rising demand for certificates. Table 1 and Figure 3 show the amount of the quota and its development between 2003 and 2030. The structure of the quota means that demand is relatively price inelastic, due to the fact that electricity suppliers have an incentive to purchase certificates up to a price that is 50% higher than the average price for the year. This is because, for each certificate that they do not cancel, they are required to pay a quota obligation charge of 150% of the average price of certificates over a period of one year leading up to the date of cancellation.

The purpose of the electricity certificate system is to increase the production of electricity from renewable energy sources. Both competition and technical development have been important long term starting points for reducing the costs of electricity production from renewable energy sources, and thus for achieving the established target. If the target is to be achieved, the quota obligation must be increased as time passes. At the same time, such an increase must be based on a reasonable estimate of a likely increase in production of electricity from renewable energy sources. The value of the quota is therefore set also with consideration of expectations of future electricity production from renewable sources and from peat, as well as with forecast values of electricity use in Sweden for each year. Table 1 shows that the actual accumulated result in 2006 amounted to 5.66 TWh of electricity, which shows that the system is in good accord with development, as the forecast for the year was 5.89 TWh.

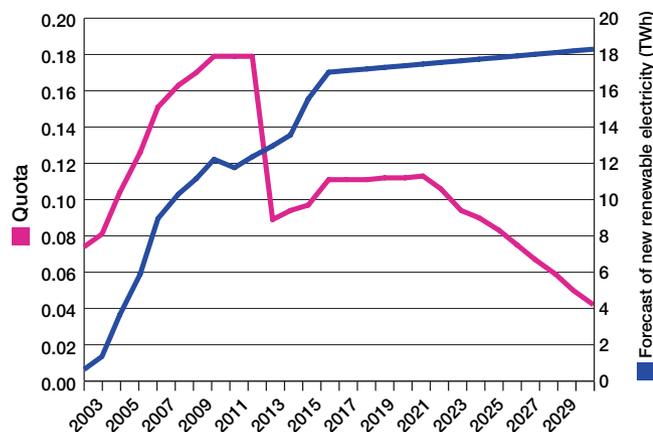
At the end of 2012, certain production plants will be phased out of the certificate system. This will have the effect of re-

**Table 1.** Quotas for the period 2003–2030, forecast new renewable electricity production capacity and actual renewable electricity production.

Year	Quota	Forecast of new renewable electricity (cumulative) [TWh]	Actual result (cumulative increase) [TWh]
2003	0.074	0.64	1.96
2004	0.081	1.35	4.55
2005	0.104	3.65	4.80
2006	0.126	5.89	5.66
2007	0.151	8.96	
2008	0.163	10.30	
2009	0.170	11.15	
2010	0.179	12.22	
2011	0.179	11.76	
2012	0.179	12.36	
2013	0.089	12.96	
2014	0.094	13.56	
2015	0.097	15.55	
2016	0.111	17.02	
2017	0.111	17.11	
2018	0.111	17.20	
2019	0.112	17.29	
2020	0.112	17.38	
2021	0.113	17.47	
2022	0.106	17.56	
2023	0.094	17.65	
2024	0.090	17.74	
2025	0.083	17.83	
2026	0.075	17.92	
2027	0.067	18.01	
2028	0.059	18.10	
2029	0.050	18.20	
2030	0.042	18.29	

Source: Bill no. 2005/06:154; Bill no. 2006/07:1; Svenska Kraftnät's accounting system, Cesar

**Figure 3.** Quota obligations 2003–2030, and forecast new renewable electricity production.



Source: Bill no. 2005/06:154; Bill no. 2006/07:1

ducing electricity production from renewable energy sources and from peat in the system, thus also reducing the number of certificates available. In order to adjust the demand for certificates, the quota will therefore be reduced in 2013, as can be seen in Table 1 and Figure 3. A smaller number of plants will be phased out at the end of 2014, and so the increase in the quota will be correspondingly slightly flattened. However, the production plants that leave the certificate system in this way are expected to continue to produce electricity from renewable sources, as they will be commercially viable by then even without the additional revenue provided by the certificates. In total, renewable electricity production will increase, as certificates will have to be purchased from new plants.

### Varying quota obligation sizes

Companies having quota obligations are electricity suppliers, electricity intensive manufacturing companies and electricity users to the extent that they have used electricity that they have themselves produced, imported or purchased on the Nordic electricity exchange. Up until the end of 2006, it was also possible for other electricity users to manage their quota obligations, but this possibility has now been withdrawn. The amount of electricity sold or used varies widely among the

companies having quota obligations, which creates substantial differences in the sizes of the obligations. 84% of those having a quota obligation had an obligation of 10 000 certificate units or less during 2006, equivalent to total annual sales or use of electricity of somewhat over 9.4 GWh during the year. The quota obligations for these companies and individuals amount to only about 6% of the total quota obligations. The three largest companies in the system have an obligation amounting to about 35% of the total obligation.

### Not subject to the obligation

Free power, and electricity used as ancillary power for electricity production, are exempted from the quota obligation, as are losses arising in connection with operation of the transmission or distribution networks. Electricity intensive companies are exempted from having a quota obligation for electricity use in manufacturing processes, although other electricity used in the company is quota liable. If these companies are to be exempted from the quota obligation, they must notify themselves to, and be registered with, the Swedish Energy Agency, and must also submit annual returns of their electricity use in the same way as other companies having quota obligations. The reason for exempting these companies from having quota obligations is to ensure that the competitiveness of Swedish electricity intensive companies is not affected by the higher costs of electricity that would result from having a quota obligation.

With effect from the beginning of 2007, companies are defined as electricity intensive if the use of electricity in their manufacturing processes amounts to 40 MWh per million SEK of the company's total sales value of goods and products. Electricity used in the manufacturing process is exempted from the quota obligation to the following extent:

- 50%, when electricity use amounts to at least 40 MWh/SEK million, but less than 50 MWh/SEK million, of the company's sales value
- 75%, when electricity use amounts to at least 50 MWh/SEK million, but less than 60 MWh/SEK million, of the company's sales value
- 100%, when electricity use amounts to at least 60 MWh/SEK million of the company's sales value.

During 2006, 262 companies were registered as electricity intensive in accordance with the old exception rules (the standard industrial classification code in Sweden), with an exempted electricity use amounting to 40.5 TWh. For 2007, 445 companies are registered in accordance with the new exemption rules. During the spring of 2007, the Swedish Energy Agency was instructed by the Government to investigate the use of the concepts of 'energy' and 'electricity intensive' in Swedish legislation, and to propose changes to the conditions for quota obligation exemption in the electricity certificate system. This is in order to investigate the feasibility of harmonising the concepts, and to investigate whether the new exemption rules could result in distortion of competition between different companies having similar activities. The work, which is to be concluded in December 2007, includes putting forward proposals for changes.

### Cancellation of certificates and quota obligation charge

The electricity certificate system requires those having quota obligations to purchase certificates to a quantity as needed to fulfil their quota obligation. If they have purchased too few certificates, they are required to pay a quota obligation charge for each certificate by which they are short of the required number. By not later than 1st March each year, companies submit an annual declaration of the amount of electricity sold or used during the previous year, which provides the basis for calculation of companies' quota obligations. Certificates are cancelled on 1st April on the basis of the information in the returns. If a company holds insufficient certificate units in its account, it is required to pay a quota obligation charge to the state, based on the number of units shortfall. This charge amounts to 150% of the volume weighted average price of certificates during the period from the previous 1st April until 31st March of the following year. During 2003 and 2004, this charge was limited to SEK 175 and SEK 240 respectively for each certificate unit, in order to protect consumers against runaway electricity certificate prices. In practice, this had the effect of setting price levels and operating as a price ceiling for certificates, thus undermining the effectiveness of

**Table 2.** Cancellation of electricity certificates, 2003–2006.

	<b>Cancellation for quota obligation years:</b>			
	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
<b>Quota obligation, electricity [MWh]</b>	63 337 834	97 400 976	97 608 470	97 042 948
<b>Exempted electricity for electricity-intensive companies [MWh]</b>	37 842 768	40 626 792	40 899 530	40 475 457
<b>Quota</b>	0.074	0.081	0.104	0.126
<b>No. of electricity certificates cancelled</b>	3 489 984	7 832 352	10 119 869	12 391 446
<b>Quota obligation fulfilment</b>	77.0%	99.2%	99.9%	99.9%
<b>Quota obligation charge [SEK per certificate]</b>	175	240	306	278
<b>Total quota obligation charge [million SEK]</b>	182.8	14.4	3.1	2

*Source: The Act (2003:113) Concerning Electricity Certificates; Svenska Kraftnäts accounting system, Cesar; Swedish Energy Agency*

the system. With effect from 2005, there has been no price ceiling to the quota obligation charge. Apart from the first year of the system, the proportion of cancelled certificates in relation to the overall quota obligation has been over 99%, as shown in Table 2.



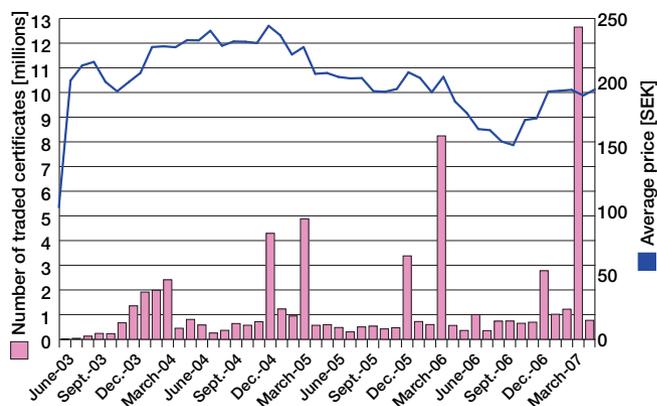
# Trading with electricity certificates

*Electricity certificates exist only in electronic form, which cannot be converted to a paper format. Producers and those having quota obligations have accounts in Svenska Kraftnät's electronic register system, Cesar. Trading involves transfer of certificates from a seller's account to a purchaser's account in Cesar.*

Trading on the electricity certificate market occurs both through bilateral agreements, directly between producers and those having quota obligations, and through contract purchases involving the services of a broker. The brokers play an important part in arranging the transfer of electricity certificate products between purchasers and sellers. This function has been very important during the early years in order to initiate trading on the certificate market, largely because the market is of limited size. Svensk Kraftmäkling (SKM), one of the largest brokers on the Nordic electricity market, calculates that, in 2006, certificates traded bilaterally and those traded via brokers both amounted to about 40% of the market. According to SKM, the remaining approximately 20% of transactions consisted of contracts entered into during previous years, either bilaterally or via brokers. Bilateral agreements consist of purchases of a company's own electricity production certificates for its own electricity sales activities, and of large portfolio customers having electricity certificate production and choosing to sell their certificates through their portfolio administrators. A trend that arose in 2007 is for more parties to trade their certificates via brokers in order to obtain the market price for the certificates, as this is nowadays part of the price of electricity exposed to competition. Long multi year contracts are less popular than they used to be, in that there is not the same wish to ensure a fixed price.

Trading in electricity certificates can be carried out in a number of ways. There are spot contracts, involving direct transactions in certificates. There may also be contracts applicable over longer periods of time, such as transactions in certificates in March and December during a given year, or in March over the next three years, known as forward contracts. Certificates are most commonly transferred to purchasers' accounts in March, so that those having quota obligations ensure that their accounts hold the necessary number of certifi-

**Figure 4.** Average price for transactions of electricity certificates between Cesar accounts, and monthly turnover in certificates from May 2003 until April 2007.



Source: Svenska Kraftnät's accounting system, Cesar

ates as close to the cancellation date as possible, as Svenska Kraftnät makes a charge for holding certificates in its Cesar register. The account charges for Cesar are regulated by the Ordinance (2003:120) Concerning Electricity Certificates. The next most common practice is to transfer the certificates in December, which is due partly to annual accounting considerations. Figure 4 shows the turnover in certificates since the start of the scheme.

Producers of certificate entitled electricity operate under, or experience, different conditions when selling their allocated certificates. The main differences are to be found between large and small producers, with the small producers being more dependent on a continuous sale of their certificates in order to assure revenue flows and thus maintain production. It is common, among the larger producers, for there to be less need directly to link revenue from the sales of certificates to continued production, which means that these producers can afford to wait for a better price for their certificates before they sell them. However, it is mainly the particular conditions of each company that determine when and how certificates are sold, with fluctuations in the general economy or liquidity requirements being decisive factors in determining when certificates are traded.

### The price of electricity certificates

On a competitive market, the price of certificates is determined by the relationship between supply and demand. As far as the electricity certificate market is concerned, liquidity plays an important part in this, as the market is relatively limited. On a market with only a few active traders, certificate prices are more sensitive to changes in supply and demand, and therefore can fluctuate more easily. However, there are also other factors that affect the price. During 2003 and 2004, the quota obligation charge had some effect on the price of certificates, in that its value was determined and announced in advance. The price is also affected by the costs of various risks and future expectations of price and market developments. Figure 5 shows the price of certificates in March each year since the scheme started on 1st May 2003.

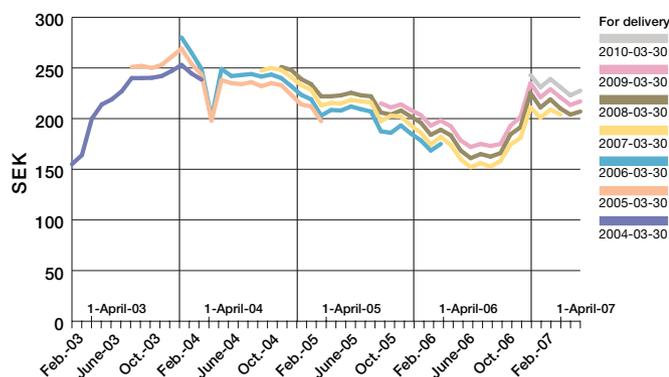
It can be seen from the diagram that the average price of certificates contracted on 2nd January 2007, and for delivery in March 2009, was SEK 235 per certificate.

As previously mentioned, one factor that affects the price is the supply/demand relationship. The supply of certificates on the market is difficult to forecast: there is at present a relatively large surplus of certificates on the market, as can be seen in Figure 1. During the first years, the accumulated surplus of certificates increased, although there had been a

slight fall at the end of 2006/beginning of 2007, indicating that somewhat fewer certificates were issued in 2006 than were sought by purchasers. At the end of 2006, the surplus amounted to somewhat more than half the quantity of certificates needed to meet the quota obligation for 2006. Future price development of certificates is largely dependent on the extent to which larger production expansion plans are realised.

The price of a certificate is recorded when the certificate is transferred between accounts in Svenska Kraftnät's Cesar register, although the transaction and price may have been agreed well before this. The price statistics in Figure 4 show the volume weighted average price of all transactions during the respective months, and must therefore not be seen as the market price of certificates during the relevant months. However, it does happen that the price in Cesar is used as a reference price for certain transactions on the certificates market.

**Figure 5.** Average price of electricity certificate transactions in March.



Source: SKM





# Electricity consumers contribute to renewable electricity

Producers of electricity from renewable energy sources receive economic support for doing so through the electricity certificates. The money for the certificates comes from consumers' electricity bills, and enables the electricity producers increasingly to invest in the production of electricity from renewable energy sources. The cost efficiency of the certificate system has increased since the system started: In 2006, producers received over 70% of the money.

The objective of the electricity certificate system is to increase electricity production from renewable energy sources by 17 TWh by 2016, in comparison with corresponding production in 2002. This is a very ambitious target, when seen in comparison with the period from 1997 to 2002, for which the target was to increase electricity production from renewable energy sources by 1.5 TWh. Since 2002, Sweden's electricity production from renewable energy sources has increased by 5.1 TWh, or about 3.6% of the country's total electricity production in 2006. The fact that the producers choose renewable energy sources is largely due to the extra revenue received via the certificates.

Since 1st January 2007, electricity suppliers' costs for certificates is included as part of the price of the electricity that they sell. This change was introduced in order to improve cost efficiency and to make it easier for consumers to compare electricity prices between suppliers. However, what is unaltered is that the certificate system represents a cost for consumers, in that the producers' extra revenue comes from consumers and is paid by them via the suppliers' electricity bills. However, not all the money paid by the consumers reaches the producers: some of it is used to pay value added tax, transaction costs by the electricity suppliers and quota obligation charges. A rough calculation can be made to see where the money goes.

During 2006, electricity consumers paid an average price of 3.4 öre/kWh (including value added tax) for electricity certificates. This price is based on the suppliers' returns of price information to the Swedish Energy Agency, and applies for electricity customers using less than 50 MWh per year. It can vary for other electricity customers. During the year, the total quota obligated use of electricity amounted to 97 TWh of electricity, giving a total cost for electricity certificates to consumers of approximately SEK 3300 million, of which SEK 660 million were for value added tax. Of this, the total contribution from domestic consumers amounts to

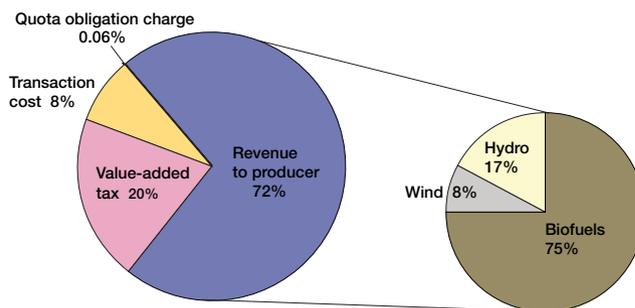
about SEK 1200 million, based on an assumed electricity use of 36 TWh, with the remaining SEK 2100 million coming from other electricity users in society. The remainder of the consumers' costs, SEK 270 million, is accounted for by the electricity suppliers' transaction costs for items such as administration, wages, trading brokers' fees, other fees and risk costs. Figure 6 shows the percentage breakdown of the costs, and also the fact that over 70% of the input revenue reached the electricity producers. It can clearly be seen from the figures for 2003–2006 in Table 3 that the proportion of the payments reaching the producers has increased each year.

**Table 3.** Consumers' estimated costs for electricity certificates, 2003–2006.

	2003	2004	2005	2006
Consumers' average costs, incl. VAT [öre/kWh]	2.4	3	3.3	3.4
Quota obligation electricity [TWh]	63.3	97.4	97.6	97
No. of certificates cancelled [million]	3.5	7.8	10.1	12.4
Average price per certificate [SEK]	201	231	216	191
Producers' revenue from certificates [million SEK]	701	1 809	2 186	2 367
VAT, 25% [million SEK]	304	584	644	660
Quota obligation charges [million SEK]	183	14	3	2
Electricity suppliers' transaction costs [million SEK]	331	514	388	270
Electricity consumers' costs for electricity certificates [million SEK]	1 519	2 922	3 221	3 298

Source: Swedish Energy Agency

**Figure 6.** Estimated breakdown of electricity consumers' costs for electricity certificates in 2006.



Source: Swedish Energy Agency



# Production of renewable electricity

Electricity certificates are issued to those who produce electricity from various renewable energy sources, and from peat, and who have had their production plants approved by the Swedish Energy Agency. To date, certificates have been issued to producers of electricity from biofuels and peat, wind power, hydro power and solar energy. Production from the renewable sources amounted to 11.6 TWh in 2006, which is 5.1 TWh more than corresponding production in 2002.

Electricity production entitled to certificates has increased since the start of the certificate scheme, mainly in the form of increased production of electricity from biofuels as a result of using a greater proportion of renewable fuels, or by an increase in capacity of existing biofuel plants. Table 4 provides further information on electricity production from sources entitled to certificates, from 2003 to 2006. Note that a plant can consist of one or more production units, e.g. a wind farm with several wind power units is regarded as one plant.

Certificate entitling electricity production during 2006 amounted to 12.1 TWh. Directive 2001/77/EC does not classify peat as a renewable fuel, and so the quantity of electricity produced from it must therefore be subtracted from the total amount of electricity from renewable sources. Electricity production from renewable energy sources within the electricity certificate system amounted to 11.6 TWh in 2006, having increased from 6.5 TWh in 2002. This represents an increase of 5.1 TWh since 2002.

**Table 4.** Production and installed capacity, by types of power source, 2003–2006.

	2003 May–Dec.	2004	2005	2006
<i>Number of plants [1]</i>	1 597	1 759	1 848	1 909
Hydro	966	1 040	1 060	1 075
Wind	543	613	668	706
Biofuels, peat	87	105	118	125
Solar	1	1	2	3
<i>Installed capacity [MW] [2]</i>	4 049	4 161	4 471	4 765
Hydro	491	504	517	540
Wind	401	472	530	583
Biofuels, peat	3 157	3 185	3 424	3 643
Solar	0.008	0.008	0.011	0.036
<i>Electricity production – renewables and peat [MWh]</i>	5 637 559	11 048 438	11 298 378	12 156 855
Hydro	963 637	1 968 325	1 799 446	2 018 577
Wind	455 642	864 546	939 125	988 340
Biofuels	4 218 276	7 670 770	7 925 790	8 593 538
Peat	–	544 791	634 012	556 380
Solar	4	6	5	20

[1] Number of plants assigned more than 0 certificates in each year

[2] For plants assigned more than 0 certificates

Source: Svenska Kraftnäts accounting system, Cesar

**Table 5.** Plants started up during 2002 or earlier, until 2006.

Production (2006) in plants Commissioned in [GWh]	Bioenergy	Hydro power	Wind power	Solar energy	Peat	Total
2002 or earlier	7 815	1 849	519	0.005	506	10 690
2002–2003 (Jan.–April)	506	20	130		44	699
2003 (May–Dec.)	26	10	77		0	112
2004	54	27	108		6	194
2005	119	83	110	0.002	0	312
2006	74	31	44	0.013	0	149
Production 2006 [GWh]	8 594	2 019	988	0.020	556	12 157

Source: Swedish Energy Agency; Svenska Kraftnäts accounting system, Cesar

Electricity production from renewable energy sources can be increased through the construction of new plants or by increases in production from existing plants. Since the certificate system started on 1st May 2003, a total of 260 new plants have been started up by the end of December 2006, of which 190 are wind power plants, 35 are biofuel power plants, 33 are hydro power plants and two are solar electricity plants. In 2006, the plants that have been started up since 2002 produced about 1.4 TWh of electricity, thus giving an increase of about 3.7 TWh from existing plants, excluding the contribution from the use of peat.

### Wind power

Although wind power today supplies less than 1% of Sweden's total electricity production, it has the potential to supply a greater proportion, making it an area of political priority. In its Bill No. 2001/02:143, Cooperation for Reliable, Effective and Environmentally Friendly Electricity Production, the Swedish Parliament has set a national planning target of 10 TWh/year of electricity from wind power by 2015. The Swedish Energy Agency has been instructed to determine a new planning target for 2020. However, the 10 TWh/year target for 2015 will require a substantial expansion of wind power production facilities, both onshore and offshore, which will affect the supply of electricity certificates. Increasing the proportion of Sweden's total electricity production supplied by wind power will require, for example, coordinating further construction of wind farms and shortening the planning and approval times for construction applications. However, there are many areas where improvement is required if the expansion of wind power production is to be assisted. Regulations, the planning process and problems with connection of supplies affect the cost efficiency of wind power expansion, and thus also the electricity certificate system.

Technical development in the wind power sector has been explosive. Twenty years ago, wind power plants had an output of a few hundred kilowatts, while today plants with outputs of 5 MW are being built. Most expansion to date has been inland or near coasts, but offshore plants are now increasingly being planned. It is expected, for example, that the Lillgrund offshore wind farm in Öresund will be com-

missioned in 2007. However, at present, offshore wind power production is more expensive than onshore production, and requires higher revenue levels. Nevertheless, dedicated research and experience from a growing number of projects should enable costs to be reduced in the future. Offshore wind power production facilities are already in operation in the UK, Ireland, Denmark and the Netherlands. Construction in Germany is expected to start over the next few years, while other countries, such as Belgium, are planning offshore wind power production. The Swedish Lillgrund wind farm is being built with financial assistance from the state fund for market introduction of wind power. A new tranche of this support has been decided for the 2008–2012 period, and can result in more offshore construction projects.

### Planned wind power production

There are many wind power projects planned for construction over the next few years, with the projects at present having reached various stages, ranging from the initial planning and outline design stage to going through the formal planning application process, which is often time consuming. As a result, it is difficult exactly to forecast when wind power plants can be started, or indeed whether all projects will be realised. Another cause of delay is that, at present, delivery times of components such as turbines are very long. Table 6 is a summary of some of the projects having a total installed

**Table 6.** Planned wind power projects with total installed capacities exceeding 25 MW, for construction and commissioning 2007–2009.

Project	Company	No. of wind turbines	Calculated production [TWh]
Lillgrund wind farm	Vattenfall AB	48	0.33
Havsnäs wind farm	RES Skandinavien AB	48	0.25–0.37
Uljabuouda	Skellefteå Kraft AB	12	0.10
Vänern	Vindpark Vänern Kraft AB	10	0.10
<b>Total</b>		<b>118</b>	<b>0.78–0.90</b>

Source: Swedish Energy Agency's listing of projects with a total installed capacity over 25 MW

capacity of 25 MW or more, and for which construction is in progress or will start during 2007, for start up over the period 2007–2009.

#### *Lillgrund wind farm*

The Lillgrund wind farm is Sweden's so far largest wind power development, and one of the largest in the world. Construction is in progress, and it is expected that the farm will start to operate at the end of 2007. It consists of 48 turbines, each with an installed capacity of 2.3 MW. The site lies out to sea, seven kilometres south-east of the Öresund bridge, and about ten kilometres in each direction from the Swedish and Danish coasts. Annual electricity production is expected to be about 330 GWh, equivalent to supplying the demand of over 12 500 electrically heated detached houses<sup>1</sup>.

#### *Havsnäs wind farm*

The Havsnäs wind farm consists of 48 turbines, each with an installed capacity of 2 MW. The turbines will be sited on the three peaks of Ursåsen, Ritjelsberget and Järvsandsberget between Alavattnet and Havsnäs-Järvsand, about 20 km north of Strömsund, in the county of Jämtland. Annual calculated production from the farm should be 250–370 GWh, equivalent to the load of over 9500–14 000 electrically heated detached houses<sup>2</sup>.

#### *Uljabuouda*

Uljabuouda will consist of 12 turbines probably each with an installed capacity of 3 MW. It will be constructed on the Uljabuouda low fell in Arjeplog, Norrbotten county. It will create an important fund of knowledge and experience for establishment of upland based wind power. Annual expected electricity production is 100 GWh, sufficient to supply about 3800 electrically heated detached houses<sup>3</sup>.

#### *Vänern*

The Vänern wind farm project involves the construction of an offshore wind farm at the northern end of Lake Vänern, having ten turbines. It is expected to provide experience and help

to reduce the costs of future projects, primarily through improvements in logistics and foundation design/construction. Annual expected electricity production is about 90 GWh, equivalent to the energy demand of about 3 400 electrically heated detached houses<sup>4</sup>.

#### *Wind power plants*

706 wind power plants, of which four are offshore, were granted certificates in 2006. Several production units, close to each other with a common connection point to the grid, are counted as one plant: in total, the 706 plants consisted of 855 turbines. Total installed capacity in 2006 amounted to 583 MW. Table 7 shows production output, installed capacity and number of wind turbines in 2006, classified by year of commissioning.

Average installed capacity of wind turbines commissioned in 2006 was 1.1 MW, which can be compared with an average installed capacity of 0.81 MW for units commissioned in 2003. This shows that the per unit installed capacity for wind turbines has increased.

491 companies or private persons were issued with electricity certificates for wind power production plants in 2006: 78% of them own only one wind power plant. The sizes of the plants vary, but 90% of them have an installed capacity not exceeding 1500 kW.

**Table 7.** Number of wind turbines, installed capacity and production during 2006, classified by year of commissioning.

<b>Year of commissioning</b>	<b>No. of wind turbines</b>	<b>Installed capacity [MW]</b>	<b>Production in 2006 [GWh]</b>
2001 or earlier	554	300	519
2002–2003 (Jan.–April)	80	68	130
2003 (May–Dec.)	60	50	77
2004	51	55	108
2005	62	57	110
2006	48	53	44
<b>Total</b>	<b>855</b>	<b>583</b>	<b>988</b>

Source: Svenska Kraftnäts accounting system, Cesar; Swedish Energy Agency

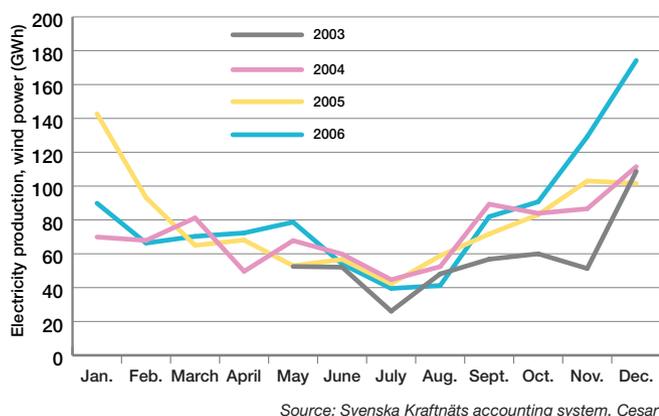
1, 2, 3, 4. The example is based on an average demand of 26 200 kWh/year from a Swedish detached house. Source: Statistics Sweden

### Production

Wind power production varies with the wind conditions, and therefore changes with time, depending on climate conditions. 2003, 2005 and 2006 were relatively calm years, while winds in 2004 came up to the statistically average climate conditions. Figure 7 shows the amount of electricity production for which certificates were issued between the time of starting the system and the end of 2006. Total electricity production from wind power in 2006 amounted to 988 GWh.

Together with the Swedish Association of Electrical Utilities, the Swedish Energy Agency is responsible for monitoring production from wind power plants, with the aim of collecting production data from all the wind power plants in the country. The introduction of the electricity certificate system has created a second, parallel channel, with information on electricity production from the annual returns submitted as part of the electricity certificate system. As most wind power plants are covered by the certificate system, production figures from this source are more comprehensive. As a result, the figures for electricity production from wind power as given in this report are somewhat higher than the corresponding figures in the operational monitoring scheme.

**Figure 7.** Electricity certificates allocated to producers of electricity from wind power, May 2003 – December 2006.



### Biofuels and peat

With its substantial areas of forest and arable land, Sweden is in a favourable position to produce biofuels. The energy in the fuel can be utilised efficiently and with little environmental effect by burning the fuel in CHP plants, producing both electricity and heat. The heat can be supplied to a public district heating system, or be used in industrial processes. If used in industry, this process is referred to as industrial back pressure production. Since the beginning of the 1980s, the proportion of biofuels used in CHP plants has steadily increased, and the electricity certificate system has provided a further incentive for changeover to the use of renewable fuels.

### Peat

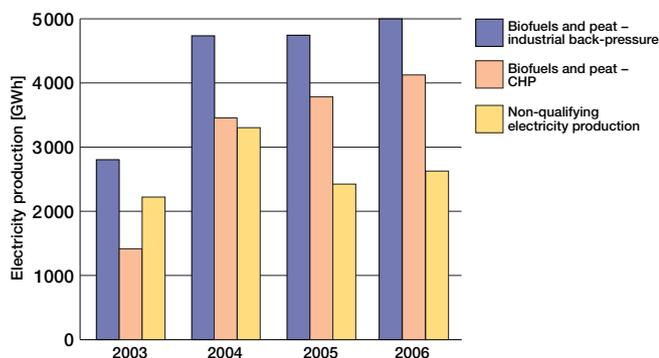
Peat is an indigenous energy asset which, in a strict meaning, is not classified as a renewable fuel. Nevertheless, on 1st April 2004, the scope of the electricity certificate system was expanded to include the use of peat as a fuel in CHP plants. The reason for this was based on environmental considerations: by making electricity production from the combustion of peat eligible for the receipt of certificates, it would prevent the use of peat as a fuel in CHP plants from being displaced by the use of coal.

With this change, electricity production from the combustion of peat in CHP plants became entitled to certificates. In 2006, there were 16 such plants burning peat, producing about 556 GWh of electricity, or about 78 GWh less than were produced in 2005.

### Plants

For the purposes of the electricity certificate system, biofuelled plants are divided up into CHP, industrial back pressure and biogas. All approved biofuel plants in the certificate system make monthly reports of their total electricity production, and of the proportions of biofuels, peat and other fuels used. Certificates are then issued to the plant owner for that part of the electricity production based on biofuels and peat. Figure 8 shows electricity production from approved biofuelled plants from 2003 to 2006. It can be seen from the diagram that production from certificate entitled fuels in CHP plants is continuing to increase. The proportion of renewable fuels and peat used for electricity

**Figure 8.** Electricity production in approved biofuelled plants, 2003–2006.



Source: Svenska Kraftnät's accounting system, Cesar

production differs between biogas and CHP plants, and also between them and industrial back pressure plants, as can be seen in Table 8. It can be seen that electricity production from biofuelled plants amounted to 11.8 TWh in 2006, which was

**Table 8.** Electricity production from renewable energy sources and peat, total electricity production and proportion of renewable fuels in relation to total fuel supply in approved biofuelled plants, 2003–2006.

	2003 May–Dec	2004	2005	2006
Renewable electricity production, including peat [GWh]	4 218	8 216	8 560	9 150
Industrial back-pressure	2 804	4 735	4 744	4 999
CHP	1 415	3 456	3 783	4 125
Biogas	0	25	32	26
Total production [GWh]	6 285	11 519	10 984	11 777
Industrial back-pressure	3 238	5 215	5 146	5 411
CHP	3 047	6 278	5 785	6 310
Biogas	–	25	53	56
Proportion of renewable fuels [%]	67.1	71.8	77.9	77.7
Industrial back-pressure	86.6	90.8	92.2	92.4
CHP	46.4	55.0	65.4	65.4
Biogas	–	99.8	61.6 [1]	46.5

[1] In 2005, one plant used only a very small proportion of biogas, which explains the substantial change in percentage proportion between 2004 and 2005.

Source: Svenska Kraftnät's accounting system, Cesar

an increase of 7% over production in 2005. In CHP production, the proportion of certificate entitled fuels has increased from 54.4% to 56.6% over the two years, excluding the use of peat.

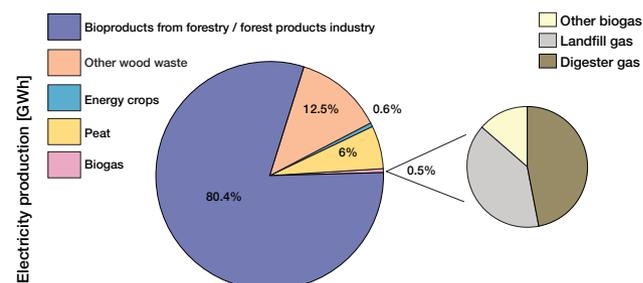
The approved biofuel-fired plants vary very considerably in size, in terms of electricity production from renewable energy sources. About half of the plants receive less than 25 000 certificates in 2006. In total, these plants received 4% of the certificates that were issued for production from biofuels and peat. The ten largest plants received a total of 36% of the certificates for production from these fuels.

### Production

Electricity from plants that partly or entirely produce electricity from biofuels or peat is entitled to certificates. The biofuels that are included in the certificate system are defined in the Ordinance (2003:120) Concerning Electricity Certificates. Bill No. 2005/06:154 Renewable Electricity with Green Certificates states that biomass in mixed domestic refuse is not covered by the electricity certificate system.

Waste and by products from forestry and the forest products industry, such as black liquors, chips and felling residues, form the single commonest type of biofuel that is eligible for the receipt of certificates. Figure 9 and Table 9 show that other wood industry waste and peat are also used to a considerable extent.

**Figure 9.** Biofuels used in approved biofuelled plants in 2006.



Source: Svenska Kraftnät's accounting system, Cesar

**Table 9.** Production in approved biofuelled plants, 2003–2006, by type of fuel.

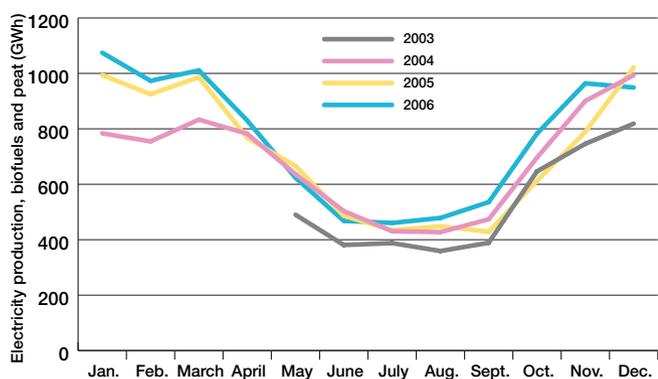
Year	Fuels entitled to certificates						Fuels not entitled to certificates					
	Energy crops	By-products from forestry / forest products industry	Landfill gas	Digester gas	Other biogas	Other wood waste	Peat	Total renewables and peat	Agricultural waste and by-products	Domestic waste	Industrial waste	Other
2003 May-Dec	–	–	–	–	–	–	–	4 218.3	–	–	–	2 066.5
2004	59.1	6 542.8	16.2	16.2	2.0	1 034.3	544.8	8 215.6	11.2	112.4	84.6	3 094.7
2005	50.7	6 743.3	15.2	24.1	4.9	1 087.6	634.0	8 559.8	12.2	123.9	71.4	2 216.7
2006	52.3	7 357.8	17.1	20.4	5.8	1 140.1	556.4	9 149.9	0.3	131.7	64.2	2 431.3

Source: Svenska Kraftnåts accounting system, Cesar

The information in the table is based on the biofuel returns submitted by the plant owners. The returns in 2003 included less detail, which means that production in that year cannot be exactly assigned to all categories.

Electricity production from renewable fuels and peat varies during the year, as can be seen from the production statistics shown in Figure 10.

**Figure 10.** Electricity certificates issued to producers of electricity from biofuels and peat in bio-energy plants, May 2003 – December 2006.



Source: Svenska Kraftnåts accounting system, Cesar

## Hydro power

Historically, hydro power is a very important energy source in Sweden, and nowadays – on average – supplies almost half of Sweden’s total electricity production. Generally, construction of new hydro power plants, or modifications to increase the output from existing plants, involves very heavy investments. Hydro power plants that are covered by the electricity certificate scheme, with the aim of increasing hydro power based output, are therefore entitled to certificates as follows:

- small scale hydro power that was in operation at the end of April 2003 and had an installed capacity not exceeding 1500 kW per production unit
- new plants
- resumption of operation in plants that had been taken out of operation before 1st July 2001, and which were then started up again after the end of 2002
- increased production capacity from existing plants
- plants that can no longer be viably operated in the long term due to decisions by public authorities or to extensive re-building.

### Plants

Hydro power plants from which production qualifies for electricity certificates cover a range of sizes. Small scale plants, with a maximum installed capacity of 1500 kW per production unit, dominate, as shown in Table 10. During 2006, 558 companies were issued with certificates for 1075 hydro power plants. Several production units, grouped closely together and having a common connection point to the grid, are counted as one plant.

### Production

Electricity production from hydro power varies from one year to another, depending on such factors as precipitation. 2003, 2004 and 2006 were dry years, while 2005 was a wet year with good water availability. Figure 11 shows production from approved hydro power plants since the start of the system in May 2003 and the end of 2006.

### Solar electricity

Solar electricity is produced by solar cells, which are the only technology available today that can convert solar energy directly to electricity. Today, solar cells have an efficiency of about 15%. There are thousands of small solar cell installations, e.g. for private homes, on sites where it would be expensive to connect them to the electricity network.

**Table 10.** Electricity certificates issued to producers of electricity from hydro power production in 2006, by category.

Type of production	No. of plants	Electricity certificates assigned	
		[number]	[%]
Small-scale hydro power	1 027	1 868 511	92.6
Restarted production	12	4 005	0.2
New hydro power	21	42 703	2.1
Production increase	14	72 317	3.6
Concession [1]	1	31 041	1.5
<b>Total</b>	<b>1 075</b>	<b>2 018 577</b>	<b>100</b>

[1] Concession to plants that are no longer operationally viable, due to public authority restriction or extensive rebuilding.

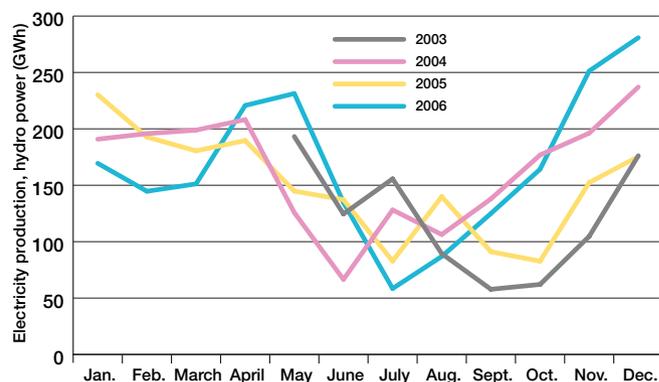
Source: Svenska Kraftnät's accounting system, Cesar; Swedish Energy Agency

Solar electricity plants are generally relatively small in comparison with, for example, wind power plants or CHP plants. For approval for inclusion in the electricity certificate system, production plants must meet the requirement for hourly metering and reporting of electricity production. For small plants, this becomes very expensive per MWh of production: in such cases, the cost of metering can exceed the revenue from the electricity certificates, which is one reason why very few solar electricity plants are registered in the system.

### Plants and production

Three approved solar electricity installations were included in the system in 2006, having an installed capacity of 36 kW and producing 20 MWh/year. It can therefore be seen that, at present, solar electricity contributes only a marginal quantity of electricity within the certificate system.

**Figure 11.** Electricity certificates issued to producers of electricity from hydro power over the period May 2003 to the end of 2006.



Source: Svenska Kraftnät's accounting system, Cesar



## Limited allocation

*The purpose of the electricity certificate system is to encourage production of electricity from renewable energy sources and from peat. However, in order to prevent commercially viable older plants from abusing the certificate system and creating unjustifiable higher costs for electricity consumers, there is a time limit on the right to receive certificates. Limiting the period of certificate issuance reduces consumers' costs for the electricity certificate, which is important when the overall target objective of increased production is raised.*

Plants commissioned after 1st May 2003 are entitled to receive certificates for up to 15 years, but in no case after the end of 2030. These plants will be steadily phased out of the electricity system during the year concerned, depending on their date of starting up.

Production plants that were commissioned before the start of the certificate system on 1st May 2003 are entitled to certificates until the end of 2012. Plants started before 1st May 2003, and which have received some form of public grant for investment or conversion of the plant, are entitled to certifi-

cates until the end of 2014. However, any such grant must have been issued after 15th February 1998, as part of a programme of investments in the energy sector.

The installed capacity of plants due for phase out at the end of 2012 and 2014, as well as those due for phase out over the period 2018–2021, is shown in Table 11.

Table 12 shows the corresponding phase out of production over the years concerned, based on annual average values of the plants' certificate entitling production during 2005 and 2006, which means that the values may change if operating conditions change. The relatively short history of the electricity certificate system means that annual average values are at present based on only a few production years, which can create some uncertainty of forecasting. The longer the periods for which annual average values can be calculated, the less the significance of structural and systematic changes. An example of this is the increase in proportion of certificate entitled fuels in bio-energy plants. Other factors that can affect the expected production values are external conditions such as precipitation, temperature and wind. As the forecast is based only on operating statistics, it will be adjusted with time.

**Table 11.** Phase out of production capacity, 2012–2021.

	2012	2014	2018	2019	2020	2021	Total
<b>Wind [MW]</b>	130.6	239.6	40.8	61.7	58.3	55	586.0
<b>Hydro [MW]</b>	488.2	1.9	5.1	6.9	14.0	22	538.0
<b>Biofuels [MW]</b>	3 268.0	216.1	–	21.1	63.5	135	3 703.5
<b>Solar [MW]</b>	0.008	–	–	–	–	0.028	0.036
<b>Total [MW]</b>	<b>3 886.8</b>	<b>457.5</b>	<b>45.9</b>	<b>89.7</b>	<b>135.8</b>	<b>212</b>	<b>4 827.6</b>

Source: Svenska Kraftnät's accounting system, Cesar; Swedish Energy Agency

**Table 12.** Phase out of production, 2012–2021.

	2012	2014	2018	2019	2020	2021	Total
<b>Wind [GWh]</b>	216	458	67	120	113	131	1 105
<b>Hydro [GWh]</b>	1 762	7	20	32	59	97	1 975
<b>Biofuels [GWh]</b>	7 854	798	–	23	160	522	9 357
<b>Solar [GWh]</b>	0.005	–	–	–	–	0.003	0.008
<b>Total [GWh]</b>	<b>9 832</b>	<b>1 263</b>	<b>87</b>	<b>174</b>	<b>331</b>	<b>750</b>	<b>12 437</b>

Source: Svenska Kraftnät's accounting system, Cesar; Swedish Energy Agency

# Glossary/Explanation of Terms

**Auxiliary power** is electricity used in connection with the production of electricity (e.g. fans, pumps etc.).

**Cancellation** of electricity certificates means that the certificates are returned to the state from the account, in Cesar, of the party having a quota obligation. Cancellation of certificates occurs on 1st April, covering the previous year's quota obligation.

**Cesar** is Svenska Kraftnät's electronic accounting system for certificates. Parties eligible for receiving certificates, or wishing to purchase or sell them, must hold a certificate account in Cesar.

**Combined heat and power** is the use of a thermal process, e.g. a steam boiler, for the combined production of electricity and heat.

**Electricity certificates** are issued by the state, and provide electronic proof of production of 1 MWh of renewable electricity in accordance with the Act (2003:113) Concerning Electricity Certificates.

**Electricity intensive companies** are manufacturing companies, using a manufacturing process which, during a calendar year, uses at least 40 MWh of electricity for each SEK million of sales value of the company's production.

**Electrical losses** are losses that occur in operating the electrical transmission or distribution grid.

**Electricity suppliers** are suppliers of electricity that has been produced by themselves or by some other producer. In addition to companies whose main business activity is the supply of electricity, this means that other suppliers, such as property-owners who supply electricity to their tenants, are included in this category.

**Forward contracts** are agreements to purchase at a particular time in the future, and at a price determined at the date of entering into the contract.

**Free power** is electricity supplied to a user without charge, in accordance with an agreement for compensation for loss of potential benefit or commodity.

**Industrial back pressure power production** is the simultaneous production of heat (normally in the form of process steam) and electricity in an industrial production plant.

**Parties having quota obligations** are:

- electricity suppliers, supplying electricity to end users
- electricity users, to the extent that they have used electricity that they themselves have produced, imported or purchased on the Nordic electricity exchange
- electricity intensive companies.

**Producer entitled to certificates** is the operator of a plant that produces electricity from renewable energy sources or from peat, and who has had the plant approved by the Swedish Energy Agency for receipt of electricity certificates. Approval for inclusion in the electricity certificate system means that each producer is allocated one certificate unit per produced and metered MWh of electricity.

**Production entitled to certificates** is electricity production from renewable energy sources or from peat, and meeting requirements in the Act (2003:113) Concerning Electricity Certificates.

**Quota obligation** is a requirement each year to cancel (on 1st April) electricity certificates representing the sale or use of electricity during the previous year.

**Quota obligation charge** must be paid by any party having a quota obligation who does not cancel the necessary number of certificates corresponding to the obligation. During 2003 and 2004, there were ceilings on this charge, of SEK 175 and SEK 240 respectively, for each 'missing' certificate, in order to protect consumers against runaway certificate prices. With effect from 2005, the quota obligation charge has been set at 150% of the volume weighted average price of electricity certificates over the period from the preceding 1st April until the following 31st March.

**Returns for electricity production from bio-energy and from peat** must be received by Svenska Kraftnät by not later than the 15th of the month following the production month. The return must state what proportion the respective fuels constitute of the total quantity of energy input.

**Returns from those having quota obligations** must be submitted by not later than 1st March each year, with the necessary information for the previous calendar year. Returns give details of the quantity of electricity sold, the quantity used and any deductions for such qualifying purposes as electricity use in electricity intensive manufacturing processes, auxiliary power, free power and electrical losses.

**Renewable energy sources** are those that do not consume the earth's resources, and thus have little effect on the environment. Examples of renewable energy sources include wind power, solar energy, wave energy, geothermal energy, biofuels and hydro power.

**Sales value** in electricity intensive companies is defined as the sales value of the company's total production over the calendar year. The sales value of any unsold products produced during the year is calculated on the basis of the sales price of corresponding goods that were sold during the year.

**Small scale hydro power** includes plants with an installed capacity up to 1500 kW.

**Spot contracts** are contracts that have been entered into at the current market price, and under which electricity certificates are transferred from seller to purchaser within one week.

**Svenska Kraftnät (SvK)** operates the Swedish high voltage distribution grid. SvK also maintains the electronic accounts of certificates in the electricity certificate system, with responsibility for its accounting system Cesar.

## Links

On its website, the **Swedish Energy Agency** publishes market statistics such as the number of approved production plants and of registered companies and private persons having quota obligations, information on which electricity producers from whom electricity certificates can be purchased, and also other general information on the electricity certificate system. This report is also available on the site in electronic form.

[www.swedishenergyagency.se](http://www.swedishenergyagency.se)

On its website, the **Svenska Kraftnät** provides constantly updated information on such statistics as the number of issued, traded and cancelled certificates, as well as on the certificates' average price.

<https://elcertifikat.svk.se/>

## Sources, references

- Bill no. 2003/04:42, Peat and Electricity Certificates
- Bill no. 2002/03:40, Electricity Certificates to Assist the Use of Renewable Energy Sources
- Bill no. 2005/06:154, Renewable Electricity with Green Certificates
- Act (2003:113) Concerning Electricity Certificates
- Ordinance (2003:120) Concerning Electricity Certificates
- STEMFS (2006:07) on Electricity Certificates
- Svenska Kraftnät's Cesar IT support system
- The Swedish Energy Agency's Electricity Certificate System
- Statistics Sweden, Energy statistics for detached houses, apartment buildings and other premises, 2005
- Energy in Sweden 2006, ET 2006:45
- Svensk Kraftmäkling, (SKM)



[www.swedishenergyagency.se](http://www.swedishenergyagency.se)

### **An efficient and environmentally friendly energy system**

The Swedish Energy Agency is Sweden's central agency for energy matters. Our work is aimed at establishing an environmentally friendly, reliable and efficient energy system in Sweden, and also at assisting such work on an international level. We support measures intended to improve the efficiency of energy markets, with a greater element of renewable energy. We exercise surveillance of the activities of network companies, and are responsible for the country's overall energy preparedness for crisis situations. We support a large number of research and development programmes in the energy sector in conjunction with universities, institutes of technology and industry.

This report, the *Electricity Certificate System, 2007*, is intended to make statistics on the electricity certificate system more easily accessible, and to increase understanding of the system. It brings together, and comments on, statistics from the Swedish Energy Agency and from Svenska Kraftnät's IT-system.



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